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ABSTRACT

This newsletter contains items of interest to anyone concerned with science and society interactions. The first section of this issue contains 20 news and communication items including several program descriptions, discussions of social issues related to science, and descriptions of three bibliographies. Three feature articles are also included. The first is a commentary on the need to integrate questions of science, technology, and policy. The second article contains two recent surveys dealing with codes of ethics in the social sciences. The last feature article is an individual's reaction to the proposed science court. A general bibliography is also included. (MR)

NEWSLETTER ON SCIENCE, TECHNOLOGY & HUMAN VALUES

(Formerly: Newsletter of the Program on Public Conceptions of Science)

January 1977 Number 18

CONTENTS

Vivien B. Shelanski

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A few copies of earlier issues are still available.

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TABLE OF CONTENTS

TABLE OF CONTENTS (contd.)

I. NEWS ITEMS AND COMMUNICATIONS

A. Research Community Voices Concerns in NSB Report

The eighth annual report of the National Science Board (NSB), Science at the Bicentennial: A Report from the Research Community, is now available. Unlike earlier reports, Science at the Bicentennial is not a statistical analysis of trends or indicators, but consists largely of comments by several hundred representatives of the U.S. research community on existing and prospective problems in research operations.

The Foreword to the report states that the NSB "undertook this collection of views in response to clear evidence that scientific research, after a period of relative well-being, is today exposed to severe stress. That stress originates in fundamental changes in such matters as age patterns in the population, the availability and distribution of economic resources, and the order of values guiding national directives."

To obtain the views of the research community, letters of inquiry were sent to more than nine hundred performers and administrators in the four principal sectors of research: universities, industry, federal laboratories, and independent research institutes.

Two outstanding features emerged from the hundreds of replies. One was the commonality of judgment, across all sectors, as to what the major problems are. The second was the intensity of concern about these problems and about the prospects for science in the immediate future.

The principal areas of common concern were:

-- dependability of funding for research
-- vitality of the research system
-- freedom in research
-- confidence in science and technology

The report contains separate chapters on each of the four areas of concern. Also included are a chapter providing historical perspective on research in the U.S. and a study of available surveys on public attitudes toward science and technology.

The various appendices provide details about the methods used in the study; texts of the letters of inquiry; a complete list, by sector, of respondents; a complete list of issues cited in the responses; and rank-order tables of issues mentioned most frequently.

The report is available from the Superintendent of Documents, U.S.

Government Printing Office, Washington, D.C. 20402. The price is $2.95, stock number 038-000-00280-5.

B. Symposium: Scientific Freedom and Responsibility

A symposium entitled "Case Studies in Scientific Freedom and Responsibility" will be held on Monday, February 21, 1977, at the annual meeting of the American Association for the Advancement of Science (AAAS) in Denver, Colorado. Morning and afternoon sessions will be held in the Spruce Room of the Denver Hilton Hotel. Speakers at the morning session will discuss some of the issues involved in different areas of scientific freedom and responsibility. In the afternoon, members of the AAAS Committee on Scientific Freedom and Responsibility will summarize the initial directions of the group and explore several options available to AAAS. Discussion by the audience will follow the presentations.

The program follows:

Morning Session. 9:00 a.m.

"The Emergence of Critical Science," Jerome R. Ravetz; "Changing Perceptions of Scientific Freedom and Responsibility," William A. Blanpied; "Public Participation in the Issues: Asilomar and Its Aftermath," Charles Weiner; "Issues of Scientific Freedom and Responsibility in Pre-college Education," F. James Rutherford.

Afternoon Session. 3:00 p.m.

"Charge to the AAAS Committee on Scientific Freedom and Responsibility," H. Bentley Glass; "Legal Constraints on Scientific Freedom," Harold P. Green; "Legislative Issues," Charles A. Mosher; "Scientific Societies and the Public Interest," Frank von Hippel.

The symposium is being sponsored by the AAAS Committee on Scientific Freedom and Responsibility (see NL #17, p. 7). Five working groups were formed at the first meeting of the committee in October. They are the Subcommittees on: Infringements of Scientific Freedom in Foreign Countries; Infringements of Scientific Freedom in the United States -- Individual Appeals; Boundaries of Scientific Freedom -- Ethical and Legal Limits; Professional and Social Responsibilities of Scientists; Freedom of Science Teaching.

For a description of projects being developed by the subcommittees, see "Persecution, Limits to Scientific Freedom to Be Studied by Committee," Science 194, 3 December 1976: 1036-1037.

C. Science, Technology, and Society: A Guide to the Field

By Ezra D. Heitowit
Program on Science, Technology, and Society
Cornell University

To provide a clearer picture of the emergence of the important interdisciplinary area of study involving the interaction of science and technology with society, the Cornell University Program on Science, Technology, and Society has undertaken the documentation of academic activities in "science, technology, and society" (STS). This is a general term for such topical designations as science and technology policy, ethical and human value implications of science and technology, science and humanities, technology assessment and forecasting, technology and human affairs, etc.

An initial step toward providing an information base for the STS area is the production of a document entitled Science, Technology, and Society: A Guide to the Field. The directory illustrates the current level of teaching and research activity in the STS area at U.S. colleges and universities, and indicates educational resources for STS studies available both within and outside the academic community. To facilitate communications among persons working in the field, the directory also includes a roster of individuals and groups and their associated scholarly interests.

The survey of STS activities was undertaken in conjunction with an assessment, sponsored by the National Science Foundation, of the current state of STS instruction and the need for and availability of curriculum materials. Particular attention was paid to what types of teaching materials are used, how programs are conceived and organized, and which student and faculty constituencies are involved.

The information on courses and programs contained in the directory is derived from questionnaires mailed to all colleges and universities in the U.S. Information, varying in degree of detail and completeness, is included on approximately 2300 courses from nearly four hundred institutions.

The section of the directory entitled "Program Profiles" includes program objectives, institutional arrangements, degrees offered, future plans, and other information for 132 formal STS programs.

The compilation of resources for teaching and research in STS studies has several components. A list of readings used in courses has been generated from the more complete survey responses. Separate sections list curriculum materials and related documents available

from individual teachers and university programs, and sources of information on commercially available print and audiovisual materials. Also compiled is a list of recent bibliographies, and a selected and annotated list of periodicals and newsletters.

Descriptions of the STS-related activities of a number of research corporations, government agencies, professional organizations, public interest groups, and private foundations are also included.

Science, Technology, and Society: A Guide to the Field is 577 pages and is available from Cornell University, Program on Science, Technology, and Society, 620 Clark Hall, Ithaca, New York 14853, for $8.00 prepaid (to cover the cost of printing and mailing).

D. Survey of Science Writing Courses

An informal survey of science writing and science communication courses is being conducted by Sharon Friedman of Lehigh University, Rae Godell of the Massachusetts Institute of Technology, and Lawrence Verbit of the State University of New York at Binghamton. The group plans to publish the information in an annotated directory of science communication courses and programs, and to use the directory in planning a conference on communicating science to the public.

The directory will include information about courses and programs in science writing, science journalism, science communication, science and the media, etc., at the undergraduate and graduate levels, in science as well as journalism and humanities departments.

Anyone whose course or program might be appropriate for the directory should send a post card or short note indicating name, address, telephone number, and course title(s) to: Dr. Rae Goodell, Room 20B-224, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, (617) 253-4069. The group would appreciate hearing from people who can refer them to others teaching in this field.

Each person whose name is submitted will be contacted to obtain further information for the directory. Everyone listed in the directory will receive a copy.

E. Journal to Feature "Value Issues in Science, Technology, and Medicine"

Professor Kenneth F. Schaffner, Editor-in-Chief of Philosophy of Science, wishes to announce a special issue of the journal. The special number, tentatively scheduled for December 1977, will be devoted to "Value Issues in Science, Technology, and Medicine." This theme will be broadly interpreted to include, for example, the relations of value theory and science, analyses of the aims and goals of science, decision-theoretic inquiries into utilities (especially epistemic utilities), value components of paradigms (or theories), philosophy of technology assessment, and those ethical and value aspects of medicine closely associated with medicine's scientific base.

Contributors should follow standard instructions for submissions printed inside the back cover of the March 1976 issue of the journal. Essays must be received no later than 1 May 1977 to permit time for review. Manuscripts should be sent to: Professor Kenneth F. Schaffner, 314 Loeffler Building, Department of History and Philosophy of Science, University of Pittsburgh, Pittsburgh, Pennsylvania 15260.

F. New Serial Publication: Sociology of Sciences, a Yearbook

This annual publication will bring together articles around particular themes in the sociology of the sciences as a means of contributing to the development of a comparative, cross-disciplinary understanding of the sciences. By publishing research from a number of perspectives and approaches on a specific topic, the Yearbook will provide an opportunity for the integration of different disciplinary strategies and their interrelated development. The term "sociology" in the title is meant broadly, and includes historical and philosophical dimensions. The basic standpoint of the Yearbook views the sciences as a plurality of socially constructed ways of comprehending natural and social phenomena. Comparisons across cultures and historical periods will be a major feature of the Yearbook.

Volume I, to appear in spring 1977, is The Social Production of Scientific Knowledge, edited by E. Mendelsohn, P. Weingart, and R. D. Whitley. Volume II, 1978, is The Dynamics of Science and Technology: Social Values, Technical Norms and Scientific Criteria in the Development of Knowledge, edited by W. Krohn, E. Layton, and P. Weingart. Volume III, 1979, is Countermovements and the Sciences: Science and Anti-Science, edited by H. Nowotny, H. Rose, and J. R. Ravetz.

Ordering information is available from the publisher: D. Reidel Publishing Company, Inc., Lincoln Building, 160 Old Derby Street, Hingham, Massachusetts 02043, U.S.A.

G. Citizen and Science Almanac and Annotated Bibliography

The Citizen and Science Project of the Poynter Center on American Institutions (Indiana University) announces publication of a guide and basic bibliography for the development of college courses or seminars on the relationship of science to the American public: The Citizen and Science Almanac and Annotated Bibliography, compiled by M. C. LaFollette.

This guide could also be used for adult education groups or other interested citizens or by the teacher who wants to incorporate several of the topics into an existing course (e.g., American Government).

The "Almanac" section is divided into thirteen major topics (such as, "science and the mass media," "science and government," or "criticism of science"). Each of the numerous specific subtopics contains a short list of primary references; discussion of the relation of the subtopic to the larger subject; suggestions for class discussions, lecture topics, or assignments; and other useful references.

The annotations in the 500-reference bibliography are also directed specifically to the teacher or student teacher.

Emphasis throughout the document is on the public role of the social institution of science, its interaction with other institutions and the actions and attitudes of citizens.

The Citizen and Science Almanac and Annotated Bibliography was written to fill a specific need -- for a basic, easy-to-use, inexpensive guide to a complex, multi-disciplinary area of study.

The 129-page volume is available for $2.50 from : The Poynter Center, 410 North Park Avenue, Bloomington, Indiana 47401.

H. Bibliography: Risk-Benefit Analysis and Public Policy

A 79-page volume entitled Risk-Benefit Analysis and Public Policy: A Bibliography has been compiled by E. M. Clark and A. J. Van Horn of the Energy and Environmental Policy Center at Harvard University. Although the entries in the document are not annotated, they are listed in 26 different sections. Examples of categories include: Environmental Risks and Ecological Costs; Public Perceptions of Risks and the Psychology of Risk-Taking; Public Health, Epidemiology, and Disease; Occupational Safety; Public Policy, Science and Decision-Making.

A companion to the bibliography is "The Status of Risk-Benefit Analysis," by Andrew Van Horn and Richard Wilson. The paper reviews the status of methods and techniques for assessing risks, enumerating benefits, and evaluating their trade-offs.

Information about the availability of the Bibliography and paper may be obtained from Andrew Van Horn, Energy and Environmental Policy Center, Jefferson Physical Laboratory, Harvard University, Cambridge, Massachusetts 02138.

I. Bibliography of Society, Ethics and the Life Sciences

The Bibliography is an annual publication of the Institute of Society, Ethics and the Life Sciences, Hastings-on-Hudson, New York. The 1976-77 edition, partially annotated, contains listings in the following categories: introductory readings; ethical theory; history of medical ethics; codes of professional ethics; medical ethics education; values, ethics, and technology; behavior control; death and dying; experimentation and consent; genetics, fertilization, and birth control; scarce medical resources, transplantation, and hemodialysis; truth-telling in medicine; confidentiality.

There are special sections on the National Commission for the Protection of Human Subjects, the Asilomar Conference, and the Karen Quinlan case.

Single copies are $4.00 and may be ordered from: Office of Publications, Institute of Society, Ethics and the Life Sciences, 360 Broadway, Hastings-on-Hudson, New York 10706.

J. "Science and Social Issues: Stimulating Discussion and Involvement"

This 60-page AAAS report, by Richard A. Scribner and Frances Zorn, describes and analyzes an experiment in "social-issue communication and involvement" which took place at the 1975 annual meeting of the American Association for the Advancement of Science. The objectives of the experiment were to enhance discussion among the attendees about important social issues, to provide data on the methods used, and to test the suitability of the AAAS meeting setting as a focal point for activities which could lead to regional resource banks of scientists and engineers.

Data were gathered through the use of a Feedback Ballot, which consisted of: (1) ten questions about science and society issues, with four specific options and one null-choice for each question; (2) four questions to determine the respondents' levels of interest in the issues; and (3) six options to determine the respondents' preferred modes of involvement.

Ballots were filled out by approximately three hundred persons,

of the 4800 attending the meeting. Of the fifty possible "issue" options, only three received a majority of the respondents' "votes": (1) "Scientists should be actively concerned with the social consequences of their discoveries" (52%); (2) "A new energy conservation ethic and a redefinition of societal advancement need to be developed" (70%); and (3) "Government should regard support of science and engineering more as long-term investments" (53%). The areas of energy, population, and views of the future held considerable interest. Nearly 60% of the respondents indicated a desire to participate in "action-taking" or "issue-definition" activities.

"Science and Social Issues: Stimulating Discussion and Involvement" is available on request from: The Office of Special Programs, AAAS, 1776 Massachusetts Avenue, N.W., Washington, D.C. 20036.

K. Center for the Culture of Biomedicine and Science: University of Delaware

The University of Delaware has recently established a research and teaching facility, the Center for the Culture of Biomedicine and Science. Directed by Dr. Edward Lurie (history), the core faculty includes members of the departments of philosophy, English, and sociology.

Two academic programs are being offered under the auspices of the Center: the program for the culture of biomedicine, and the program in science, technology, and society. The Center is sponsoring a lecture series and is developing plans for several publications: an annual series, "The Philosophy and Technology Annual Compilation of Research," and "The Guide to Science, Technology and Medicine."

The Center plans to appoint a national advisory committee and to initiate a study of the historic and contemporary role of science and technology in the development of the Delaware Valley.

For additional information, contact: Center for the Culture of Biomedicine and Science, University of Delaware, Newark, Delaware 19711.

L. Program: Law, Science, and Technology at Franklin Pierce Law Center

Franklin Pierce Law Center in Concord, New Hampshire, was established in 1973 as a privately supported, national law school. From its inception, meeting the challenges resulting from the interactions of law with science and technology has figured prominently in the goals of the Law Center. Because of the awareness of the importance of multi-disci-

primary technical issues at the Law Center, there is a tendency to give such issues more thorough treatment in traditional courses than they might otherwise receive. In addition, students may specialize in the Law, Science, and Technology Program, which has four components: courses and seminars; clinical and internship opportunities; research projects in the Law Center and its institutional affiliates; and conferences. Faculty for the Program are trained not only in law, but in one or more technical or scientific areas.

Courses offered in the Law/Science-Technology Curriculum include: Introduction to Law and Technology; Science in the General Practice; Law and Science Interfaces; Technology, Law, and the Working Environment; Federal Regulation of Science and Technology; Environmental Law; Regulation in the Consumer Interest; and Selected Topics in Chemical Regulation.

The Law Center has established Law/Science Exchange Programs with the University of Strasbourg and the Max Planck Institute in Munich.

Additional information about the program may be obtained from the Franklin Pierce Law Center; Concord, New Hampshire 03301.

M. Program: Graduate Studies at the Institut d'Histoire et de Sociopolitique of the Université de Montréal

The Institut d'histoire et de sociopolitique des sciences of the Universite de Montréal has inaugurated a program leading to the Ph.D. degree in the history and sociopolitics of science. The course of study is two years for students who have already completed the M.Sc. or M.A. degree, or its equivalent, in a related field. A dozen students from Canada and several foreign countries are now enroled in the program, which integrates the history, sociology, and politics of science. The program is designed to train graduates for careers in government and industry, as well as in more traditional academic settings.

Teaching faculty include: Camille Limoges, Brigitte Schroeder-Gudehus, Geneviève Benezra, Jean-Claude Guédon, Lewis Pyenson, and Yakov Rabkin. Additional lectures are given by visiting scholars.

A permanent program of faculty and student exchanges exists between the Institut and the History of Science Department of the Johns Hopkins University. Students without previous graduate training may enrol in a two-year M.Sc. program.

For more information concerning studies at the Institut, write: Le Directeur, Institut d'histoire et de sociopolitique des sciences, Université de Montréal, c.p. 6128, succursale A, Montréal, P.Q. H3C 3J7, Canada.

N. Program: Science Studies at the University of Edinburgh

A B.Sc. Degree with Honors in Science Studies is now being offered at the University of Edinburgh. (Honors degrees require four years of study instead of the three years for ordinary degrees.) The Science Studies degree program combines courses in science with studies designed to explore the social context and nature of scientific knowledge.

Initially, two scientific concentrations are offered within the degree -- physics and zoology. For the first two years of the degree, the program is essentially the same as for students intending Honors in either physics or biological sciences.

The "contextual" studies include material from the history, philosophy, and sociology of science, and discussions of contemporary social problems related to science and technology. They begin with a half-course in the second year, and take progressively more time until, in the final Honors year, time is divided equally between the two "streams" of the degree. A major feature of the final year is a dissertation which draws on both the "scientific" and "contextual" material, and a related program of seminars on the (historical) sociology of scientific knowledge. Over the whole four years, roughly twice as much time is devoted to the "scientific" as to the "contextual" component.

The "contextual" component of the new degree is taught by the staff of the Science Studies Unit: Barry Barnes, David Bloor, David Edge, and Steven Shapin.

For further details, write to: The Secretary, Science Studies Unit, Edinburgh University, 34 Buccleuch Place, Edinburgh, Scotland EH8 9JT.

O. Program: University of Denver

The Denver Research Institute (DRI) at the University of Denver has organized a research program designed to deal with knowledge use problems from an administrative perspective. DRI's Knowledge Utilization Program (KNUTAP) focuses attention on the roles and responsibilities of decision-makers in the knowledge utilization process -- both as users of knowledge and as the persons facilitating others' access to and use of knowledge.

The program is aimed at relating the contributions of knowledge utilization researchers to the requirements of administrators and managers. In addition to conducting DRI-sponsored research on the knowledge utilization process, KNUTAP personnel conduct research programs and workshops in the following areas: scientific and technical communications, librarianship, information science and technology, technology transfer,

and the diffusion of innovation.

Persons interested in obtaining more information about DRI's Knowledge Utilization Program should contact any of the following program principals: James E. Freeman, Ruth M. Katz, James P. Kottenstette, or F. Floyd Shoemaker, Knowledge Utilization Program, Denver Research Institute, University of Denver, Denver, Colorado 80208.

P. NSF Program: Marine Science Affairs

Rapid advances in marine science have raised a wide range of policy and management issues. To address these issues, the National Science Foundation's Office for the International Decade of Ocean Exploration (IDOE) has established a Marine Science Affairs program to support research on the social, economic, political, and managerial implications of the IDOE scientific program. The latter consists of long-term, multi-disciplinary oceanographic projects in four major areas: Environmental Quality, Environmental Forecasting, Seabed Assessment, and Living Resources.

Emphasis in the Marine Science Affairs program will be on: (1) the public policy implications of new knowledge generated by IDOE scientific programs; and (2) research likely to help improve the conduct and management of the IDOE program.

Among the kinds of public policy issues that might be addressed are the social, political, and economic implications of improved long-range weather and climate forecasts; the legal and regulatory implications of new findings in marine pollution research; the resource management implications of a capability to predict coastal upwelling; and the foreign policy implications of improved environmental predictive capabilities. Collaboration with ongoing IDOE scientific projects is seen as particularly important for analysis of these kinds of problems.

Problems associated with the conduct and management of IDOE and other large environmental research programs include the effectiveness of decentralized forms of scientific management; the nature of communication within the oceanographic community; and the effectiveness of mechanisms for getting IDOE findings to potential users. Proposals for workshops and symposia to convey significant research from both the IDOE and marine science affairs projects will also be considered for support under this category.

The program will begin with about $200,000 in Fiscal Year 1977. Additional information on the IDOE scientific program and the Marine Science Affairs program may be obtained by contacting: Program Manager, Marine Science Affairs Program, Office for the International Decade of Ocean Exploration, National Science Foundation, Washington, D.C. 20550, (202) 632-7356.

Q. Graduate Fellowship in the History of Modern Technology

The Department of the History and Sociology of Science at the University of Pennsylvania announces a renewable fellowship for graduate study offered in conjunction with the University's College of Engineering and Applied Science. Applicants interested in Western technology since 1850 are especially encouraged. The Department stresses the interaction of technology, science, and economics, and cultivates the history of science, technology, and medicine in a social context.

Students with backgrounds in engineering -- as well as historical or social science areas -- are encouraged to apply. The deadline for applications is 1 February 1977. For further information, write to: Department of History and Sociology of Science, Smith Hall, University of Pennsylvania, Philadelphia, Pennsylvania 19174.

R. Directory of Environmental Sociologists

Riley E. Dunlap, a sociologist at Washington State University, has compiled a 77-page directory of sociologists with major research interests in "environmental sociology." The Directory of Environmental Sociologists contains entries for 263 individuals who expressed a commitment to this area of study. Listings include information about current research projects, courses taught, and publications.

Single copies of the Directory may be obtained, free of charge, from: Dr. Riley E. Dunlap, Department of Sociology, Room 23, Wilson Hall, Washington State University, Pullman, Washington 99163.

S. Symposium: Philosophy and Computer Technology

On March 21 and 22, 1977, a "National Symposium for Philosophy and Computer Technology" will be held at the State University of New York, New Paltz. Supported by the American Society for Cybernetics and the American Philosophical Association, the conference will serve as a forum for interdisciplinary discussion of: (1) the relationship between artificial intelligence and the philosophy of the mind; and (2) the social and ethical implications of large-scale computerization. Among the speakers will be Drs. Kenneth Sayre and D. C. Dennett from philosophy and Drs. Roger Schank and Abbe Mowshowitz from computer science.

For additional information, contact: Dr. Martin Ringle, Philosophy Department, State University College, New Paltz, New York 12561.

II. COMMENTARY: "ON THE NEED TO INTEGRATE QUESTIONS OF SCIENCE, TECHNOLOGY, AND POLICY"

By Robert Frosch
Associate Director for Applied Oceanography
Woods Hole Oceanographic Institution

Problems of the environment, human health, and the nature and quality of life raise questions about the ways in which science and technology affect human life. These issues cannot be ignored in the formulation of public policy. To date, however, both technologists and policy-makers have been frustrated by an apparent inability to use scientific and technological means in the resolution of policy issues. Perhaps the problems previously solved with science and technology were more independent (or were treated as more independent) of human and social affairs than those we are currently facing. Recent difficulties may be the result of mistaken attempts to define and attack tightly-integrated system problems as though they were conveniently separable into questions of science, questions of technology, and questions of public policy. This is not to question the need, in policy development, for an understanding of: (1) the scientific problems and natural phenomena; (2) the technological means for using this scientific knowledge; and (3) the social aims and issues, including economic and value questions. What must be questioned, however, is the current tendency to separate these "lines of inquiry."

Consider the inadequacies of that approach. By nature, by education, and by dedication to a defined area of study, a research scientist may not recognize the applicability of his knowledge to problems that need solution, and may find it difficult to appreciate the complexities and cross-currents that the policy-makers must satisfy. Then too, the policy-maker may have little understanding of scientific thought, and thus be unsympathetic to the indefinite quality of many scientific conclusions. This is more than a "communication problem"; different modes of thought and different degrees of comfort with uncertainty in view of the need for definite decisions lead to different and often incompatible definitions of the "problem."

In short, it is not sufficient to address the scientific, technological, and policy aspects of a "problem" in isolation from each other, since the social and economic questions will have implications for the scientific questions, and vice versa. Instead, a more integrated approach is required, with mutual formulation of the problem the first step. Otherwise the result will be analyses of different or conflicting "issues," none of which addresses the underlying (but undefined) problem.

The WHOI is developing such an approach to the problems associated with "wise use of the oceans." The program stems from the need for a better scientific, technological, and policy base for the conservation of the ocean environment.

By now it is widely recognized that human activities, both inadvertent and purposeful, are part of the environmental system that affects the oceans. This is true not only of the near shore region, but of the whole continental margin, the slope, and the deep ocean itself. Although the effects of pollution are evident everywhere, both their future history and the means of controlling them are controversial matters. We have also begun to recognize the impact of fishing and the general extraction of living resources on fishes and marine animals. Additional problems are raised by deep-sea mining, increased off-shore petroleum exploitation, and possible off-shore siting of energy plants.

Despite the very evident impact of human activities on the oceans, our scientific knowledge about the environmental effects of these activities is inadequate and we know little about the technological means for controlling these effects.

The Woods Hole project will combine the efforts of science, technology, and policy experts from the earliest stages. We expect that policy questions will stimulate additional work by the scientists and technologists who in turn will help shape the policy questions in terms of present and prospective scientific knowledge and capabilities. The aim of the program is not simply to involve and interest scientists in policy questions, but to stimulate research in response to those questions.

The uniqueness of this approach lies in the notion that the dialogue on public policy between scientists and policy analysts will result in efforts on the part of the scientists to advance the state of the art in new directions. In the past, this dialogue has taken place only episodically, in terms of the existing state of the art. Combining policy analysis with a working laboratory and field operation, so they can influence each other on a continuing basis, should lead to new oceanographic science.

III. CODES OF ETHICS IN THE SOCIAL SCIENCES: TWO RECENT SURVEYS

Editor's Introduction

This section presents reports of two recent surveys of the ethical codes of professional organizations of social scientists. Both were conducted to determine the level and nature of concern about ethical issues among these organizations.

A. RESEARCH REPORT: THE INTERNATIONAL SOCIAL SCIENCE COUNCIL (ISSC) SURVEY OF CODES OF ETHICS IN THE SOCIAL SCIENCES

By Paul Davidson Reynolds
Associate Professor
Department of Sociology
University of Minnesota
Minneapolis, Minnesota 55455

Three years ago, the ISSC and UNESCO sponsored a survey designed to review the current status of codes of ethics relevant to research among national associations representing social scientists. The study was prompted by several concerns, particularly in regard to (1) the "research ethics" dilemma -- concerns associated with exposing human participants to risks in research that may benefit society as a whole, and (2) the "application of knowledge" dilemma -- concern that the knowledge developed may be utilized to advance the interest of special groups rather than society as a whole.

This survey was initiated in the fall of 1973 by contacting all national associations that could be identified as representing anthropologists, economists, political scientists, psychiatrists, psychologists, and sociologists; letters were sent to 316 associations in countries all over the world. They were asked to provide a copy of any set of standards or code of ethics relevant to the conduct of research with human participants that had been proposed or adopted.

Final report submitted to UNESCO and the International Social Science Council in March 1975. Copies may be available from Mr. Samy Friedman, Secretary General, International Social Science Council, UNESCO, One, rue Miollis, Paris XV, France. Currently being revised for publication by Allyn and Bacon. Summary appears in the International Social Science Journal 27, 4: 563-611.

The first, perhaps major, finding of the survey was that very few codes appear to exist. Nine months after the first letters of solicitation were sent, a total of 24 useful codes was returned; 16 from associations representing psychologists. Although 21 countries were represented by the codes, they tended to be those that are industrialized and have well-developed professional groups.

In order to get some sense of the issues treated by these codes, all statements related to different ethical issues associated with social scientists were identified, standardized in terms of terminology, and organized into three "composite codes": one dealing with the conduct of research (78 statements), one dealing with the relationship between social scientists and sponsoring organizations (23 statements), and one regarding the role of social scientists in organizations (29 statements).

Analysis of the statements that could be seen as relevant to the issues of conducting research with human participants (most of the codes emphasize standards for applied professionals, such as clinical psychologists) revealed a second major finding: There was no significant inconsistency among the 24 codes that had been received. In other words, not all codes treated the same issues and problems, but no two codes contained statements that were obviously incompatible -- all reflected a respect for the rights of the participants, concern that they not be mistreated or harmed, and concern that participants should be, as much as possible, willing contributors to the research activity. It appeared that the philosophical assumptions underlying the development of the available codes were shared by most social scientists, regardless of discipline or host culture, even though different aspects were emphasized in different codes.

A similar pattern or consistency was present in the composite of principles based on five codes that treated the relationship between social science investigators and sponsoring organizations. These tended to emphasize openness and honesty in the relationships between investigators and both sponsors and participants, concern for the welfare and dignity of participants, and a responsibility for ensuring that the data patterns or interpretations of investigators are not misinterpreted by sponsors.

The composite of the statements from seven codes concerning the relationship of social scientists to organizations that may employ them (distinct from relations with agencies that may sponsor research they supervise) emphasizes occupational considerations (respect for the organization, etc.), concern with confidentiality and client welfare (as in a counseling situation), and the importance of the social scientists' defining appropriate work activities (accepting only assignments they are qualified to perform). As with previous composites, no inconsistencies were present among the statements.

However, there was no single statement relating the response that a

social scientist might take if he or she disagreed with an organizational decision regarding the application of knowledge and, therefore, there are no statements regarding the "protection" of social scientists who disagree with the way in which the organization is operated. (In contrast, one code contained a principle related to public correction of sponsor inaccuracies if sponsored research findings are distorted.) This last problem appears to remain unsolved, for both an American Association for the Advancement of Science committee (Edsall, 1975) and UNESCO (1975) have considered this problem and were unable to provide a viable solution for protecting "whistle-blowers" who publicly disagree on an application of knowledge and endanger their jobs and, in some cases, their careers.[1]

The response to the survey and associated analysis indicated a lack of any explicit formal framework dealing with the major dilemmas, presented at the beginning of this brief report, among associations representing social scientists. Resolution may require some careful critical analysis on the part of social scientists and the institution of professional standards and constraints that may not be universally acceptable.

NOTES

1. A subcommittee of the recently formed AAAS Committee on Scientific Freedom and Responsibility has begun a review of "whistle-blowing" and "will work with the professional societies in developing guidelines for determining when a 'whistle-blower' needs outside support and the ways in which such support could be provided." See "Persecution, Limits to Scientific Freedom to Be Studied by Committee," Science 194, 3 December 1976: 1036-1037.

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B. RESEARCH REPORT: ETHICS AND POLITICAL SCIENCE RESEARCH: THE RESULTS OF A SURVEY OF POLITICAL SCIENCE ASSOCIATIONS

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The techniques of social science research, including those of political science, may subject human participants to a variety of adverse effects. Informed subject consent, confidentiality of findings, and the development of research-induced subject dependencies are but a few of the ethical problems raised. Because of the potential for conflict between the rights and responsibilities of researchers and subjects, I conducted a survey in summer 1975 to determine to what extent political scientists had developed professional guidelines to deal with the ethical issues associated with their research. A letter of inquiry was sent to 36 national political science associations on 16 June 1975. Each association was asked for a copy of any code of ethics governing research using human subjects adopted by its members. If no code existed, they were asked if one was currently under consideration. While it is clear that the mere existence of an ethical code, without adequate means for detecting violators and enforcing its precepts, is no guarantor of subject rights and well-being, its presence reflects at least a base level of concern among investigators for the ethical difficulties created by their research.

Sixteen associations representing political scientists in Australia, Belgium, Canada, Denmark, India, Israel, Italy, The Netherlands, New Zealand, Norway, Poland, the Soviet Union, Sweden, Switzerland, the United Kingdom, and the United States responded to the initial inquiry, a 46 percent response rate. Of the sixteen, one indicated that it hoped "to prepare such a code in the near future" (Canadian Political Science Association), one that it was participating with other national professional associations in efforts to develop such a code (Dutch Political Science Association), and a third that it has periodically considered the ethics of human research since 1968, when a Committee on Professional Standards and Responsibilities issued a report entitled "Ethical Problems of Academic Political Scientists" (American Political Science Association). The remaining thirteen associations replied that they neither had a code of ethics relating to human research nor were

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This essay summarizes the findings reported in a paper, "Ethical Issues Associated with Experimentation in Political Science," presented at the 10th World Congress of the International Political Science Association at Edinburgh, August 16-21, 1976.

they at that time planning to develop one.

It is evident from this survey that political scientists conducting research with human subjects do so without any explicit guidelines for their actions. Indeed, only one of the sixteen associations responding to the survey indicated that it was actively engaged in a planned effort to develop a code of ethics. Yet, without clear delineation of rights and responsibilities within the research setting, accountability remains elusive and all parties to the research process are left floundering in an ethical quagmire. These survey results should present a challenge to the profession to use its resources to promote meaningful and prescriptive discussions of the ethical issues and to formulate guidelines for the conduct of research.

IV. THOUGHTS ON THE PROPOSED SCIENCE COURT

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Decisions concerning science and technology, areas of policy-making long considered the domain of technical expertise, are increasingly subject to political controversy.[1] Scientists themselves are centrally involved in disputes, and their debates about the technical aspects of public policies pose difficult policy dilemmas. Decisions must often be made on the basis of uncertain and conflicting evidence. Claims about potential safety of industrial practices or products lead to rapid and often inconsistent changes in regulations, reducing predictability. Disputes among scientists create public confusion and reinforce mistrust of expertise. Technical disputes have been time-consuming, costly, and irritating, especially to a scientific community unaccustomed to airing its differences in a public forum. Thus, there are many interests eager to resolve technological controversies, and an old idea to create a "Science Court" that would bring the best judgments of the scientific community to bear on technical aspects of policy problems has been revived with considerable and widespread interest.[2]

A group of scientists, administrators, and lawyers, members of the Task Force of the Presidential Advisory Group on Anticipated Advances in Science and Technology, has proposed an experimental "Science Court," an institution that would help to resolve the "factual" dimensions of technical disputes.[3] It would employ an adversary procedure in which a panel of "sophisticated scientific judges," rather than the general public, would evaluate the technical dimensions of controversial policy problems, and issue judgments concerning the "scientific facts." The issues to be debated would be selected from controversial decisions pending before governmental agencies and must have significant factual components that can be isolated for consideration by scientists. The court would then solicit Requests for Proposals (RFP's) from scientists who wish to be advocates on various sides of the dispute. These so-called "case managers" would debate the technical questions, cross-examining each other. A panel of scientific judges, "unusually capable scientists having no obvious connection to the disputed issue," would then render a judgment.

Support for this project was provided by a joint grant from the National Science Foundation and the National Endowment for the Humanities.

The Task Force has expressed the hope "that these opinions would acquire sufficient presumptive validity to provide an improved base on which political decisions could be reached through the democratic process."[4] What is needed, claim Science Court proponents, is a relatively unbiased means to identify the value positions and interests of those engaged in technical disputes in order to arrive at the best available approximation of the current state of scientific fact. Judgments would be confined to such questions of "fact"; the Court would not recommend public action, leaving "social value questions" to the political arena. It is assumed that if contestants in a scientific controversy could agree on such procedures, then the scientific dimensions of these disputes could be clarified, providing "defensible, credible bases for policy decisions."

The concept of a Science Court was first proposed by Arthur Kantrowitz in the early 1960's. But during this period when scholars such as Daniel Bell and Marshall McLuhan were acclaiming the pervasiveness of scientific rationality in the post-industrial state, the proposal never attracted significant attention. Its recent re-emergence as an item for major public discussion stems from a conviction that subjective values and irrational fears are threatening "rational decision-making," with grave implications for future technical progress. This conviction appears to account for the interest expressed by agency administrators and industrialists at a recent colloquium attended by 250 lawyers, administrators, industrialists, and academics.[5] The concept of a Science Court received political endorsement at this colloquium from high-ranking members of the Ford Administration, such as Elliot L. Richardson (Secretary of Commerce), H. Guyford Stever (Presidential Science Advisor), and Russell Train (of the Environmental Protection Agency). It has also attracted wide attention in the media.[6]

I fear, however, that the concept of a Science Court as presently conceived could have unintended consequences, reinforcing some of the very problems it is designed to alleviate, while having minimal influence on the policy process. To explain my concern, I will briefly review some aspects of the Science Court that I find questionable, and will suggest their possible undesirable consequences. But my main interest is in using the concept of a Science Court to explore alternative mechanisms that may help to clarify the contribution of scientific rationality to controversial policy questions.

Some Questions

Facts or Values?

Underlying the concept of a Science Court is the assumption that factual statements can be debated and resolved apart from questions of "social value"; the Task Force specifically proposes procedures "through which questions of scientific fact can be separated from value-laden issues." Although Science Court proponents admit that there is no such thing as a "pure fact" or a totally value-free issue, they do claim that a "reasonable separation" will

allow judgments about scientific fact "for practical purposes."

Several questions immediately arise: Is it possible in controversial cases to distinguish fact from value? And, even if it is possible, would this separation help to resolve policy conflicts?

The claim that facts and values are distinguishable rests on assumptions about science as an autonomous and isolated activity. Arthur Kantrowitz, the leading advocate of the Science Court, believes that the very strength of science lies in its isolation from cultural and political influences.[7] But the history of science seems to suggest that even matters of "the purest fact" may be entangled with social and political presuppositions.[8] Moreover, studies indicate that technological controversies stem from factual uncertainties that allow for diverse and value-laden interpretations, and that technical questions become controversial largely because of the difficulty of determining the often-fuzzy boundaries between fact and value.[9] In short, the more controversial an issue, the greater the merger of factual questions with policy considerations. According to one study, this is especially true in the case of high cost technologies (such as the SST or nuclear power) where there is low probability of a catastrophic occurrence.[10] It is just such cases which have assumed the greatest importance.

Even if a Court could resolve some disagreements about questions of data, would this actually contribute to the resolution of controversial policy decisions? Clearly the Court will be genuinely useful only if it considers important issues. The two selection criteria proposed require that the issues have (1) significant policy importance and (2) clearly definable technical dimensions. I fear that these criteria are mutually exclusive. Experience shows that as the policy importance of an issue increases, the significance of straight-forward technical questions (compared with political and social issues) diminishes. Issues that are clearly factual, involving simple measurement and little interpretation, are either relatively non-controversial or are dealt with adequately by existing non-adversary procedures. Controversial policy questions are unlikely to be resolved primarily on the basis of scientific/technological data.

To illustrate this point, consider the various questions in the nuclear debate: Which are the most important and controversial? One participant in the Science Court colloquium, John Holdren, ranked the policy importance of nuclear power risks in the following (decreasing) order: proliferation, theft, sabotage, accidents, routine emissions. Technical data, he argued, are most useful in resolving the issues at the lower end of the policy-importance scale (i.e., routine emissions). The resolution of the more significant questions, proliferation and theft, has little to do with scientific "fact."

Finally, if scientific judgments about controversial issues are to be useful for policy purposes, they must have predictive value. Prediction, however, may rest on the way a scientist conceptualizes a problem and de-

signs the research. For example, in a dispute over the anticipated effects of waste heat from a power plant on Cayuga Lake, some scientists chose to focus on establishing base-line conditions while others focused on limiting factors such as the impact of nutrients on lake growth.[11] These choices led to quite different predictions. In addition, prediction may also rest on broad social and political assumptions. Judgments about technologies requiring continual political control (e.g., nuclear waste management) depend as much on assumptions about long-term political stability as on facts about available technologies.

In sum, the effort to resolve factual questions apart from questions of value is exceptionally difficult and, in the heated context of political controversy, may not be very useful. The point of disagreement in conflicts involving scientific information seldom lies simply in questions of scientific fact. Even differences among scientists lie more in the way they conceptualize problems than on how they measure or interpret data.

A "Court-Like" Procedure?

Another set of problems arises from the quasi-legal nature of the Science Court procedures. Several members of the Task Force deny that the proposal is analogous to the judicial court system and, in fact, this has been a major source of contention. While some have tried to change the name of the proposed institution, the only accommodation has been the tendency to refer to Science Court procedures as "court-like," in an effort to minimize the parallel. Yet the legal parallel is clearly implied by the use of an adversary process which includes "cross-examination" and "judgment." Participants in the process will have "legal counsel." Opposing parties to the disputes will present their cases before judges, whose deliberations are to be conducted in private as in a legal procedure. The Task Force hopes that Science Court judges will be able to compel disclosure using the legal power vested in government agencies.

Reliance on the legal model raises several practical problems. Should Science Court judges subpoena evidence that may interfere with the privacy of research? How can the Science Court protect itself against the problem of inundation of data? These are problems that have faced the interstate water pollution control conferences, which are also modeled on the concept of a court.[12] The "case managers" who present opposing contentions of different scientific groups are intended to be advocates, but who will choose them? Can we assume they will have reasonably equal resources to present their cases? Are the would-be impartial "judges" likely to arrive at the Science Court free of preconceptions? Distinguished scientists, after all, are not political celibates. Even if the scientific judges have no special stake in the outcome of the particular dispute, can we assume they have no predisposition? Can they avoid being influenced by the relative status of those presenting opposing viewpoints? Clearly a scientist cannot verify every fact, and a great deal of what is considered to be "fact" in science depends on "whose result you believe" (i.e., on patterns of authority).

It is ironic that just when the legal system is seeking non-judicial mechanisms for resolving disputes, scientists are turning towards a legal model. Moreover, they appear to be adopting aspects of the model uncritically. Courts of law have long recognized the difficulties of separating facts and values and have ceased to draw the kinds of rigid distinctions intended in the discussion of the Science Court. The idea that professional judges can decide issues in a value-free, objective manner was abandoned by legal scholars some forty years ago.[13] When a court of law uses expert witnesses, it recognizes that "facts" are colored by the nature of the conflict and by the orientations of the experts who present them. It is understood that experts may have blinders, if not biases, and that resolution of conflicting facts requires public scrutiny. There experts must answer the challenges of laymen.[14]

Finally, the Court analog breaks down when one considers the concept of judgment that is intrinsic to the Science Court proposal. Unlike decisions in a judicial process, judgments in this quasi-legal setting have no binding power. Judicial litigation is a zero-sum game: there is a winner and a loser. The losing party in a legal case accepts a negative decision because there is no alternative -- a court can impose sanctions to force compliance. For losing interests in a scientific dispute, however, the Science Court would not be a last resort; science activists are in any case dealing in the political arena and would continue to do so.

Some Concerns

It is undeniably appealing to attempt to isolate a domain in which scientific facts can be dealt with apart from those difficult questions of value of such concern to the public. But agreement on factual questions may, in the end, be irrelevant to policy-making and to the resolution of disputes. The impact of information depends on the political climate; if this climate is unfavorable, the most significant findings of the scientific community may be ignored[15] or, worse, distorted to fit political priorities.[16] Suppose, for example, it was shown to everyone's satisfaction that fluoridation reduces cavities and has no adverse effects. It would not automatically follow that water supplies should be fluoridated. Undoubtedly the debate would continue, for a central issue is one of government paternalism and the imposition of policies on people who may not find them acceptable. The crucial question in many disputes is less one of substance than one of process: namely, how decisions which affect the public are made. This suggests that a Science Court may have several unintended and undesirable consequences.

By institutionalizing the role of scientists in the "political business," a Science Court could be perceived as an effort to extend the policy-making authority of science. This concern underlies some of the reservations about the Court that have been voiced by public-interest scientists. While the Science Court could help them gain the resources necessary to develop their positions, it could also reduce the credibility of those who question the prevailing opinions concerning technology, and inhibit the public discourse

on controversial policies that is necessary in a democratic society. Thus, much of the criticism of the Science Court has focused on its authoritarian implications. A physicist from the Forum on Physics and Society labeled the venture "an attempt to institute a Plato's Republic of Science. Not since the time of the trial of Galileo have we had a canon court issuing pronouncements of scientific Truth."[17] Others have called the Court "a grand inquisition" and "a form of 1984 technocracy."

This is not the intention of Science Court advocates. Yet, in the very process of seeking a consensus on factual questions, scientists could find themselves making policy. Factual information carries implicit, if unstated, directives for political and social action. If a Science Court were to identify a food additive as likely to be carcinogenic, policy recommendations would be assumed to follow. Thus, if only because they contribute to an informed appraisal of policy alternatives, scientists are in the political business whether deliberately or not.[18]

When policy-makers cite "value-free knowledge" in order to bring about political consensus for government actions,[19] the political impact of scientific deliberations is enhanced. In many cases, scientific evidence can only delineate probability. Yet the very act of judgment could lead to the expectation of definitive answers as policy-makers seek an authoritative basis for decisions. The fact is that policy-makers want answers; and fact-finding committees are usually urged to go beyond their facts to make recommendations about policies based on their findings.

The perceived urgency for prompt action in technically controversial areas encourages this trend. Consequently, the pronouncements of a Science Court may be construed as far more definitive than intended. And as findings are translated for public consumption, the most tentative judgments may become definite conclusions while the subtleties and qualifications understood within the scientific community may be lost.

The proliferation of citizen groups in recent years suggests that many people feel excluded from decision-making in technological areas and resent this exclusion as inappropriate. This is confirmed by attitude surveys indicating that the public has formed "stable and definite opinions" about the potential consequences of technology and wants to influence policy.[20] Similarly, studies of technological controversies indicate that a major factor shaping the behavior of citizen groups is concern about the "arrogance" of the scientific community and the over-extension of scientific authority.[21] Slogans have already become cliches: "Don't leave it to the experts"; "The issue is too important to be left to experts"; "Policy decisions should be made by affected interests." If the Science Court reinforces the public image that experts are dominating public decisions, this would surely be counter to the intentions of the procedure.

More seriously, the Science Court could divert attention from the complex and controversial value questions that are basic to technical disputes: the level of risk acceptable in a society, the trade-offs between risks and

benefits, and the many value-laden issues that enter questions of health and human welfare. Focusing attention on factual disagreements encourages the tendency to avoid these more difficult and sensitive questions. The proposal implies that facts can be debated in a rational context while values are simply matters of action (left to the "normal decision-making apparatus") and not amenable to rational discussion at all.

Given the appeal of "value-free knowledge" as an instrument to achieve political consensus and the pervasive tendency to convert political issues into technical questions, this could have pernicious consequences. Reliance on scientific rationality allows political authority to be passive. Political choice becomes a search for appropriate strategies to implement policies that follow from scientific judgment rather than from a serious consideration of the purposes of these policies. If facts with "presumptive validity" are seen to remove the bases of contention, then ideological discourse becomes irrelevant, lay participation counterproductive, and political conflict dysfunctional. By issuing scientific judgments in controversial areas, the Science Court might encourage the tendency to define political legitimacy more in terms of competence and expertise than in terms of a democratic political process. This in turn could increase the prevailing tension between the role of expertise and democratic values.

Alternative Procedures

The above discussion is not intended to discredit the notion of a forum to resolve technical disputes, for clearly social innovation in this area is desirable. Rather, it is intended to provoke consideration of alternative procedures that could help to clarify the differences of opinion within the scientific community, yet avoid some of the above problems.

Participants in an institution which aims to establish a factual basis for policy must consider the political role of knowledge -- the implicit directives for public policy contained in scientific judgments. Scientists engaged in that enterprise must expect their findings to be shaped and perhaps even distorted by political constraints.[22] No matter how solid scientific judgments may be according to professional standards, they are likely to be perceived and selected according to prevailing social conventions and political contingencies. For scientific judgments can be used to provide justification for policies; like the medieval scholastic theologian, the modern expert is "the master of a complex canonical system against which the decisions of rule [are] evaluated and according to which they [are] justified."[23]

As scientists are increasingly involved in controversial public issues, their contribution may depend on their ability to develop procedures that take into account both the bearing of political values on "scientific fact" and the way in which scientific facts may be integrated into public policy and translated into social action. This suggests that scientists seeking to contribute to public policy cannot ignore the pressures, priorities, and

predilections of policy-makers, or avoid considering the value implications of their findings and the policies to which they may contribute. It is in this light that we must examine alternative conflict-resolving procedures.

It might be productive to consider the establishment of standing commissions to focus on the long-term controversial issues of modern technological society (e.g., environment, energy, food additives, medical technology). We presently have, of course, a system of commissions organized by the National Academy of Sciences: however, these are ad hoc, temporary groups, set up to study specific problems, and dissolved at the discretion of the Academy.[24] A more relevant example of a standing commission is the National Commission for the Protection of Human Subjects. Commissions created for other controversial policy areas could organize debates among informed people (including academics, policy-makers, representatives from citizen groups and other organizations) who hold conflicting views. The purpose of such debates would be to seek clarification rather than consensus, and especially to explore possible alternative policies and their anticipated consequences. These commissions could create advisory panels to interpret and clarify differences in technical opinion for congressional committees and to assist them at hearings. Their contributions would be a part of the public record along with other input to the public hearing process.[25] What is needed is a "translation service" to clarify for the public the diversity of opinion about controversial technologies that exists today among informed individuals:

> In this context, I find the Science Court concept most useful in its plan to organize a forum in which opposing parties confront each other on specific issues. But such a forum need not be restricted to scientists, nor should such discussions try to isolate the strictly scientific component of decisions. Surely scientists must play a major role in any discussion of issues with a significant technical component. However, I depart from the Science Court plan in maintaining that the goal should not be to resolve disputes through scientific judgment, but to create a context for discussion that will reveal the assumptions underlying different views and the multiple dimensions of policy problems that make them so difficult to resolve.

It is useful to explore some models of conflict resolution developed in several European countries.[26] One of these, now under way in Austria, focuses on disputes over the nuclear power program. The experiment is elaborately organized to give both supporters and opponents of nuclear power an equal voice. The Austrian government asked those scientists actively opposed to the government's program to submit a list of the questions concerning nuclear power that disturb them. These questions have been organized into ten themes (societal and economic questions; problems of energy policy; cost effectiveness; specific problems of energy policy in Austria; risk evaluation; security problems; control of nuclear plants and their impact on the evolution of society; radiation and waste disposal problems; cooling problems; biomedical problems). These are being considered by teams of four to six scientists representing different opinions on the issue. Each team analyzes the questions to determine which ones it can agree upon; those that

remain controversial are being debated in public forum (televised and in large meeting halls). Laymen have an opportunity to raise questions. As part of the experiment, the Ministry of Industry has published a brochure defining technical terms at a level corresponding to the minimum requirements of public school education. The debates, which began in October 1976, are not intended to resolve any technical questions, but to clarify for the public the diverse opinions within the scientific community.

This and other experiments (e.g., in Sweden and Holland) reflect quite different objectives from those that have produced the plan for the Science Court. The emphasis in the European experiments is less on the factual dimensions of technical disputes than on their political origins. The problem is located less in the questions of data than in the relationship between technology and public objectives. The recurring question is less about the level of risk than about the acceptability of risk. And the search is less for best solutions than for politically acceptable ones. In this context, the resolution of disputes necessarily requires increased public involvement in technical decisions through educational programs and participatory mechanisms. None of the countries involved in such experiments has fully resolved the problems and complexities associated with increased participation, but they are committed to these programs as a requirement for political legitimacy.[27]

In experimenting with the application of scientific rationality to public affairs, it must be assumed that conflict and criticism, even if based on erroneous premises, may in fact be useful. Surely critics of technical policy decisions have sometimes overstated their arguments and overextended their accusations. Obviously they are occasionally precipitous in their claims. Yet few would deny that criticism of technology has had some utility, if only in forcing regulatory agencies to avoid conflicts of interest, to open their procedures to increased public scrutiny, and to develop useful safety regulations. Critics, even when wrong in detail, may alert people to new questions and important problems that have been neglected. Thus, for substantive as well as political reasons, I am concerned that the goals of a Science Court or its equivalent should not be to resolve disputes, but to provide the diversity of opinion that would foster informed public debate on genuinely controversial issues.

NOTES*

*This paper has been enriched by discussions among members of the Cornell Program on Science, Technology and Society at several seminars. Max Black, Will Provine, and Marie Provine provided a great deal of useful insight into some of the philosophical and legal issues; in addition, useful criticism came from Arthur Kantrowitz and Alaz Mazur, members of the Task Force that developed the Science Court concept. While we disagree, I hope that these comments will help to develop useful means to clarify technical disputes.

1. For discussion of some of the characteristics of technological controversies, see Alan Mazur, "Disputes between Experts," Minerva 2, 1973: 243-262; Dorothy Nelkin, "The Political Impact of Technical Expertise," Social Studies of Science 5, January 1975: 34-54; Paul Doty, "Can Science Investigators Improve Scientific Advice? The Case of the ABM," Minerva X, 2, April 1972: 280-294.

2. Arthur Kantrowitz has been proposing this idea since the early days of the President's Science Advisory Council (PSAC) in the 1960's. An early article describing the concept is A. Kantrowitz, "Proposal for an Institution for Scientific Judgment," Science 156, 12 May [illegible]: 763-4.

3. Arthur Kantrowitz, "Controlling Technology Democratically," American Scientist 63, 1975: 508.

4. Task Force of the Presidential Advisory Group on Anticipated Advances in Science and Technology, "The Science Court Experiment," Science 193, 20 August 1976: 653. The Task Force claims that the present science advisory system is not adequate since advisors, to keep their credibility, must relate to the value system of the public officials they work for.

5. The three-day colloquium was held at the Xerox Training Center in Leesburg, Virginia. It was sponsored by the U.S. Department of Commerce, the American Association for the Advancement of Science, and the National Science Foundation. Discussion at the colloquium was mostly supportive. The intention was to critically examine and develop the concept, but proponents appeared to be well committed to what seemed more like a demonstration project than an experiment. For discussion of the meeting, see Philip Boffey, "Science Court: High Officials Back Test of Controversial Concept," Science 193, 8 October 1976: 167-9.

6. To give a brief indication of the variety of journals covering the issue, articles and editorials appeared in the New York Times, Chemical Engineering News, The Newsletter of the Scientists Institute for Public Information, and Science Trends. In addition, a book is being written by Mary Ames to be published by the Communications Press, Inc.

7. Arthur Kantrowitz, personal communication.

8. For general analysis of the historical relationship between scientific fact and cultural or social values, see J. R. M. Young, "The Historiographic and Ideological Context of the Nineteenth Century Debate on Man's Place in Nature," in M. Teich and R. Young, Changing Perspectives in the History of Science, London: Heineman, 1973. See also J. Habermas, "Science and Technology as Ideology," in Towards a Rational Society, London: Heineman, 1971; Stephen G. Brush, "Should the History of Science

be Rated X?" Science 183, 22 March 1974: 1164 ff.; and B. Barnes, "Internal and External Factors in the History of Science," in Scientific Knowledge and Sociological Theory, London: Routledge & Kegan Paul, 1974.

9. H. Hirsch and H. Nowotny describe nuclear controversies as "parascientific" because of their mix of scientific fact and political content. See "Controversial Issues and Information Flow in the Nuclear Power Debate," IAEA, unpublished manuscript, 1976. The fundamental ambiguities and uncertainties underlying controversies are analyzed by Mazur, op. cit.

10. Ian Clark, "Expert Advice in the Controversy about Supersonic Transport," Minerva, October 1974: 416-426.

11. Nelkin, op. cit.

12. See David Zwick and Mark Benstock, Water Wasteland, New York: Grossman, 1971: 212-217.

13. See for example the analysis of contemporary jurisprudence in Ch. 1, "The Supreme Court as Political Agency," in Martin Shapiro, Law and Politics in the Supreme Court, Glencoe: Free Press, 1964.

14. David Bazelon, "Psychiatrists and the Adversary Process," Scientific American 230, June 1974: 18-23.

15. The function and influence of scientific commissions and their relationship to the political process is analyzed by M. Lipsky and D. Olsen, "Riot Commission Politics," in Fred Harris (ed.), Social Science and National Policy, Transaction Books, New Brunswick, New Jersey: 1973. One might trace the influence of the Surgeon General's Report on Smoking to suggest the difficulties of implementing strong scientific evidence.

16. Yaron Ezrahi, "The Jensen Controversy," in Charles Frankel (ed.), Controversies and Decisions, New York: Russell Sage, 1976: 169.

17. Earl Callen, Letter to the Editor, Science 193, 10 September 1976. Also see arguments advanced by the Scientists Institute for Public Information in Scope, March, April 1976: 1-3.

18. Charles Frankel, "The Autonomy of the Social Sciences," in C. Frankel (ed.), Controversies and Decisions, op. cit.

19. See Harvey Brooks, "The Federal Government and the Autonomy of Scholarship," in C. Frankel (ed.), op. cit.: 244.

20. See Todd La Porte, They Watch and Wonder, Report to Ames Research Center, December 1975; Irene Taviss, "Survey of Popular Attitudes towards Tech-

nology," Technology and Culture 13, October 1972: 606-21.

21. Nelkin, op. cit. The perception of scientists and professionals as "arrogant" appears to be a widespread and growing problem. At a recent meeting of the American Nuclear Society citizens complained of the "arrogance" of scientists from the industry (Nuclear News, May 1975: 83). The condescension of medical professionals was claimed to influence jurists at the Edelin abortion trial. See article by Barbara Culliton, Science (31 January 1975 and 7 March 1975).

22. Ezrahi, op. cit., notes how scientists "are powerless to negate the operation of political logic in public affairs."

23. Charles Anderson, "The Logic of Public Problems," unpublished paper for the Conference on Comparative Public Policy, Cornell University, October 1976.

24. For an account of the recent dissolution of several NAS commissions see "NAS-NRC: Three Committees Cut, Leaving the Reasons Unclear," by John Walsh, Science 194, 12 November 1976: 706-708.

25. This idea has been proposed by Harvey Brooks who notes that the Nuclear Regulatory Commission is following a similar hearing procedure on plutonium recycling with a panel of experts including lawyers and engineers who are developing an orderly public record which can be used as a basis for decision. (Personal communication, October 1976.) See also Brooks' proposal for a "Technical-Analytic Court" intended to clarify and explain the choices before the public, "Environmental Decision-Making," in L. Tribe et. al., When Values Conflict, Cambridge: Ballinger, 1976: 134.

26. A more extended discussion of these experiments is in D. Nelkin, Public Involvement in Policies for Science and Technology, Paris: OECD, 1976 (forthcoming).

27. Barry Casper has written a critique of the Science Court which recommends more democratic control of technology "beyond mechanisms to promote public understanding." See "Technology, Policy and Democracy," Science, October 1976. But in a study of the fluoridation dispute, H. Sapolsky argues that technical intricacies are too great for the average voter to decide -- that increased information would only encourage negative attitudes. "Science, Voters and the Fluoridation Controversy," Science 162, 25 October 1968: 427-33; R. Alford and R. Friedland, in "Political Participation and Public Policy," Annual Review of Sociology, 1975, argue that institutionalized means of participation can only include highly organized interests; for others, protest is the only rational strategy. Thus the extent to which increased direct participation is reasonable or feasible is a matter of dispute. Some of the European experiments, however, proceed on the assumption that participation is an end in itself in democracy.

V. ADDITIONS TO GENERAL BIBLIOGRAPHY

Berg, Mark, Kan Chen, and George Zissis. "A Value-Oriented Policy Generation Methodology for Technology Assessment." Technological Forecasting and Social Change 8, 1976: 401-420.

This paper presents the rationale for, and preliminary examples of, a value-oriented policy generation methodology for technology assessment. The procedure is intended to facilitate the development of normatively based policy options for the technology under assessment. The relationship between policy generation and other aspects of technology assessment is discussed along with recommendations for future research.

Boffey, Philip M. "NSF: New Program Criticized as 'Appalling' Subsidy to Activists." Science 194, 15 October 1976: 306, 347, 349.

A modest new NSF program, "Science for Citizens," was the subject of a major congressional debate and threatened to stall agreement on NSF's FY 1977 authorization. Opposing views of the program, which has the potential to increase the technical resources of public interest groups, are reviewed in this article.

Boffey, Philip M. "The Plight of American Science: Sad Tales from Research Directors." Science 194, 22 October 1976: 409-410.

The concerns of research administrators responsible for a substantial part of the American scientific effort are presented in a report of the National Science Board, "Science at the Bicentennial: A Report from the Research Community." This article reviews the contents of the report.

Boffey, Philip M. "Science Court: High Officials Back Test of Controversial Concept." Science 194, 8 October 1976: 167-169.

Report of a colloquium on the "science court" held in late September. Although the conference was structured as a debate between proponents and opponents of the court proposal, few opposing views were presented.

Carter, Luther J. "Nuclear Initiatives: Two Sides Disagree on Meaning of Defeat." Science 194, 19 November 1976: 811-812.

In November, voters in six states defeated nuclear safety initiatives that would have set stringent legislative requirements for the construction of nuclear power plants. Proponents and opponents of the measures interpret the votes differently.

Carter, Luther J. "State Scientific Advisers: The Effort in Michigan." Science 194, 26 November 1976: 923, 972.

Recently an increasing number of states have begun to regard science advice as essential for dealing with a wide variety of economic issues. NSF has

just received a congressional mandate to fund studies, conferences, and demonstration projects directed at the institutionalization of science advice in state governments. This article focuses on the work of Michigan's science advisor.

Casper, Barry M. "Technology Policy and Democracy." Science 194, 1 October 1976: 29-35.

A critical analysis of the proposal for a "science court." The author argues that "it is true that we now lack democratic control of technology, but the science court, and even the proposed alternative adversary forums, speak only obliquely to the problem." He suggests that "a serious effort to bring about more democratic control of technology...will have to deal directly with the nature of the decision-making process per se...."

Cohen, I. Bernard. "Science and the Growth of the American Republic." The Review of Politics 38, July 1976: 359-398.

Although the U.S. emerged as a major scientific nation in the period following World War II, the author contends that "only forty years ago America could probably still be classed as an 'undeveloped' (or 'developing') country on the highest scale of the international scientific community." In the course of addressing the causes of this change and its implications, this essay provides a broad overview of the historical role of science in America.

Cohen, Richard. "Science as Fiction Makes Skeptical Fan." The Washington Post, 14 November 1976: B1-3.

One man's account of his loss of faith in science.

Cottrell, Alan. "The Rise and Fall of Science Policy." New Scientist, 14 October 1976: 80-82.

Britain's organization of government-sponsored research and development today is not completely unlike the set- twenty years ago; but the similarities mask momentous changes.

Culliton, Barbara J. "Academy Holds Open Hearing on Research Training Needs." Science 194, 19 November 1976: 813.

In a departure from past practice, the National Academy of Sciences recently held an open hearing to get comments from the public on a report of an Academy committee.

Culliton, Barbara J. "Health Manpower Act: Aid but Not Comfort for Medical Schools." Science 194, 12 November 1976: 700-704.

The Health Professions Educational Assistance Act of 1976 contains controversial provisions which define new relationships between the government

and the nation's medical schools. Some critics are contending that the cost of the bill, in terms of dollars and federal intervention in academic life, is too high. This article reviews the provisions of the Act and their history.

Culliton, Barbara J. "Helping the Dying Die: Two Harvard Hospitals Go Public with Policies." Science 193, 17 September 1976: 1105-1106.

Two Harvard University hospitals have recently developed and made public formal policies about the circumstances in which "orders not to resuscitate" dying patients could be issued. This article analyzes features of the policies and the procedures through which they were formulated.

Culliton, Barbara J. "Psychosurgery: National Commission Issues Surprisingly Favorable Report." Science 194, 15 October 1976: 299-301.

An overview of the report on psychosurgery issued by the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research.

Doderlein, Jan M. "Nuclear Power, Public Interest and the Professional." Nature 264, 18 November 1976: 202-203.

In the case of major and complex technological decisions, such as that on nuclear power, it is sometimes said that the public is unable to make a full evaluation on its own and needs to trust some established professional and political mechanism instead. In the article, the author, of the Institute for Atomenergi, Norway, comments sharply on the roles of the professionals and the nuclear critics.

Elstein, Arthur S. "Clinical Judgment: Psychological Research and Medical Practice." Science 194, 12 November 1976: 696-700.

Elstein contends that recent psychological research on judgment and decision-making has had little impact on medical practice. He suggests that modifications in research directions in psychology and alterations in medical attitudes toward that research could lead to more relevant research and improved clinical decisions.

Ganovski, S., ed. Science, Technology and Man. (Published in Bulgaria, the volume is available from: Imported Publications, Inc., 320 West Ohio Street, Chicago, Illinois 60610; price, $9.25.)

A collection of essays by Bulgarian philosophers on problems of contemporary science, technical progress, and society.

Garland, Michael. "Politics, Legislation, and Natural Death." Hastings Center Report 6, October 1976: 5-6.

An overview of the provisions and history of the Natural Death Act (a "right to die" bill) passed by the California legislature this summer and

subsequently signed by the governor.

Hammond, Kenneth R., and Leonard Adelman. "Science, Values, and Human Judgment," Science 194, 22 October 1976: 389-396.

The authors contend that "current efforts to integrate scientific information and social values in the forming of public policy are confused and defeated by the widespread use of ascientific methods -- the adversary system and the person-oriented approach. The adversary system suffers from an ascientific commitment to victory rather than truth; the person-oriented approach suffers from an ascientific focus on persons and their motives rather than on the adequacy of methods." As an alternative, the authors propose and illustrate what they describe as "a scientific framework for integrating (i) scientific information...and (ii) social value judgments...in a manner that is scientifically, socially, and ethically defensible...."

Hawk, Ernest, ed. Technology and Society Courses at the College Level. The Pennsylvania State University, 1976.

Report of a workshop on "Technology and Society on the Campus" (college-level courses as one vehicle for increasing public understanding of technology) held in October 1975 at the Pennsylvania State University.

Henahan, John F. "West German Science: Trends Mirrored in a Max Planck Institute," Science 194, 22 October 1976: 410-412.

Pressures on German science -- financial cutbacks, calls by politicians for more "people-oriented" research, and the disaffection of younger scientists -- are reflected in the Max Planck Institute for Biophysical Chemistry.

Herz, John. "Technology, Ethics, and International Relations," Social Change 43, Spring 1976: 98-113.

Originally presented at the International Symposium on "Ethics in an Age of Pervasive Technology" in Israel, December 1974, this paper examines aspects of the "compelling and comprehensive" impact of technology on international politics.

Institute of Society, Ethics and the Life Sciences. Hastings Center Bibliography: 1976-77. Hastings-on-Hudson, New York, 1976.

Partially annotated, this edition of the Bibliography lists introductory and survey works; background writings on technological developments which have contributed to the development of ethical dilemmas; and evaluations of related problems by philosophers, theologians, legal scholars, scientists, and others.

Jonas, Hans. "Responsibility Today: The Ethics of an Endangered Future." Social Research 43, Spring 1976: 77-97.

Reflections on the ethical relationship between man and nature.

Joyce, Nancy C. "Death and Dying Policy: A Bold Exchange." Science 194, 1 October 1976: 49-50.

Report of a seminar entitled "Death and Dying: An Investigation of Legislative and Policy Issues," sponsored in June 1976 by the AAAS and the Georgetown University Health Policy Center.

La Follette, M. C., compiler. The Citizen and Science: Almanac and Annotated Bibliography. Bloomington, Indiana: The Poynter Center on American Institutions, 1976. (Price, $2.50.)

A guide and basic bibliography for the development of college courses or seminars on the relationship of science to the American public. Emphasis throughout the document is on the public role of the social institution of science, its interaction with other institutions, and the actions and attitudes of citizens.

Lewin, Roger. "Genetic Engineering and the Law." New Scientist, 28 October 1976: 220-221.

In Britain, the current attempts to ensure the protection against possible hazards of genetic engineering are generating a conflict between the scientists and the law-makers.

Lipson, Leon. "Technical Issues and the Adversary Process." (Letter to the Editor.) Science 194, 26 November 1976: 890.

Although the science court proposal seeks a quasi-judicial resolution of controversies with technical components, trends within the law itself are moving in other directions.

McGinty, Lawrence. "Whose Acceptable Risk?" New Scientist, 16 September 1976: 582-583.

The British government's advisory committee has recommended that potentially dangerous processes should be subject to some form of licensing. But its report fails to address two major questions: (1) How is a major hazard to be defined? and (2) To what extent should the public be involved in deciding which risks are "socially acceptable"?

McVaugh, Michael, and Seymour Mauskopf. "J. B. Rhine's 'Extra-Sensory Perception' and Its Background in Psychical Research." ISIS 67, June 1976: 161-189.

The attempt to make investigations of psychical phenomena into an experi-

mental science originated in the work of J. B. Rhine and his associates at Duke University. This paper examines the significance of Rhine's early work for the history of parapsychology.

Morison, Robert S. "Reflections on Some Social Implications of Modern Biology." Zygon, 11 June 1976: 96-114.

On the relationship between science, especially biological science, and ethical decision-making.

National Academy of Sciences. Social and Behavioral Science Programs in the National Science Foundation. Washington, D.C.: National Academy of Sciences, 1976.

The final report of a committee which was established (at NSF's request) to examine the scope and quality of the Foundation programs in the behavioral and social sciences.

National Science Foundation. Science at the Bicentennial: A Report from the Research Community. (Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. Price, $2.95. Stock number, 038-000-00280-5.)

The eighth annual report of the National Science Board, the main body of this document consists of comments by several hundred representatives of the research community in the U.S. on existing and prospective problems in research operations. There is also a study of available surveys on public attitudes toward science and technology.

Office of Technology Assessment. Development of Medical Technology: Opportunities for Assessment. (United States Congress, Office of Technology Assessment; for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402; price, $1.80; stock number, 052-003-00217-5.)

This report addresses three central issues: (1) the need for assessing the social impacts of a new medical technology during the research-and-development process; (2) the kinds of questions that might be asked in such an assessment; and (3) by whom and at what point in the research-and-development process assessments could be conducted.

Oleson, Alexandra, and Sanborn C. Brown, eds. The Pursuit of Knowledge in the Early American Republic. Baltimore, Maryland: The Johns Hopkins University Press, 1976.

Subtitled "American Scientific and Learned Societies from Colonial Times to the Civil War," this collection of articles is the first of a projected set of three initiated by the American Academy of Arts and Sciences. Attention is concentrated on organizations in the original thirteen states, and there are separate chapters on the professionalization of science and

on particular disciplines, including humanistic studies, medicine, and agriculture. (See also the review by Keir B. Sterling in Science 194, 22 October 1976: 416-417.)

Page, Benjamin B. "Socialism, Health Care, and Medical Ethics." Hastings Center Report 6, October 1976: 20-23.

Focusing on Czechoslovakia, this essay examines the influence of Marxism and socialism on the organization of health care delivery and ethical issues in the field.

Passmore, John. Man's Responsibility for Nature: Ecological Problems and Western Traditions. New York: Scribner's, 1974.

A comprehensive examination by a noted philosopher of traditional Western attitudes toward man's relation to nature.

Philippart, Andre. "Science and Modern Politics." Government and Opposition 10, Autumn 1975: 473-491.

A comparative critical analysis of six models, drawn from Liberal, Christian, and Marxist traditions, of the relationship between scientific activity and politics.

Rabkin, Yakov. "Trends and Forces in the Soviet History of Chemistry." ISIS 67, June 1976: 257-273.

An account of the last two decades of developments in the history of chemistry in the U.S.S.R.

Ravin, Arnold W. "Science, Values, and Human Evolution." Zygon, 11 June 1976: 138-154.

The author, a biologist, focuses on several themes: authority of belief, socially motivated scientific research and unexpected discoveries, and the interdependence of science and ethics.

Restivo, Sal P., and Christopher K. Vanderpool, eds. Comparative Studies in Science and Society. Ohio: Charles E. Merrill, 1974.

The 24 articles collected in this volume are addressed to basic questions in the sociology of science. They are divided into five groups: Science and Social Structure, Science and Social Organization, Science and Politics, Science and Development, and the Third Culture of Science. Issues explored include the relation between ideology, professionalization, and bureaucratization of science and its norms; the sources of heterogeneity in the scientific enterprise; and the nature of the "international scientific community."

Rose, Hilary, and Steven Rose, eds. Ideology of/in the Natural Sciences. Two volumes: The Political Economy of Science and The Radicalization of Science. London: Macmillan, 1976.

Together the essays in these volumes present a neo-Marxist critique of science; their unifying objective is to exhibit the socially conditioned ideology of and in the natural sciences. (See the essay-review by J. R. Ravetz, "Assault on Cherished Illusions," Nature 264, 11 November 1976: 118-120.

Scribner, Richard A., and Frances Zorn. Science and Social Issues: Stimulating Discussion and Involvement. (American Association for the Advancement of Science, Washington, D.C.: 1976; AAAS Report No. 76-R-7.)

This report describes and analyzes an experiment conducted at the 1975 annual meeting of the AAAS. The purposes of the experiment were to enhance discussion among meeting participants about important social issues, to provide data on the value of the methods used, and to test the suitability of the AAAS meeting setting as a focal point for various activities.

Sewell, W. R. Derrick, and Timothy O'Riordan. "The Culture of Participation in Environmental Decision-Making." National Resources Journal 16, January 1976: 1-21.

An analysis of recent experiences with public participation in environmental decision-making in the U.S., Canada, and the United Kingdom. The cases illustrate the responses of planners and politicians to demands for increased public involvement in different cultural and economic settings. (The entire issue of the journal, published by the University of New Mexico School of Law, focuses on public participation in resource decision-making.)

Skolimowski, Henryk. "Technology Assessment in a Sharp Social Focus." Technological Forecasting and Social Change 8, 1976: 421-425.

The author argues that "Genuine Technology Assessment is, and must be, a form of sociomoral (therefore philosophical) reflection on the large scale unintended consequences of technology at large," and that "unless and until Technology Assessment is seen in a broader social and philosophic framework, it is bound to be a one-sided apologia for the prowess of existing technology."

The article is followed by responses of Kan Chen and Mark Berg, and a critique by Joseph Coates.

Steffens, H. J., and H. N. Muller, ed., Science, Technology, and Culture. New York: AMS Press, 1974.

This volume includes the papers and commentaries originally presented in 1972 at four symposia sponsored jointly by the Western Electric Company and the University of Vermont. The subjects of the meetings are indicated by the titles of the thematic papers: "Science vs. Scientific Technology," by L. Pearce Williams; "Are There Two Cultures?" by George V. Cook; "Science as a Creative Art," by Henry John Steffens; "Science and Social Responsibility," by D. K. Conover. The papers are followed by commentaries and an author's response.

Symington, James W. "Science in a Political Context: One View by a Politician." Science 194, 22 October 1976: 402-405.

Chairman of the House of Representatives Subcommittee on Science, Research and Technology, Symington offers his personal view of some of the "large issues of science policy": federal role in support of science and technology; the allocation problem for research and development; support of basic research. Public attitudes and programs to enhance science literacy are discussed in the final section.

Veatch, Robert M. Death, Dying, and the Biological Revolution. New Haven, Connecticut: Yale University Press, 1976.

A critical survey of the medical, ethical, and legal aspects of death and dying.

Wade, Nicholas. "Environmental Research: EPA Plan Termed Myopic." Science 193, 17 September 1976: 1103-1104.

In a review undertaken for the Office of Technology Assessment, scientists have criticized the five-year research plan prepared by the Environmental Protection Agency. This article reviews the points raised in the OTA report, which is the first major public criticism of EPA's research since September 1974.

Wade, Nicholas. "IQ and Heredity: Suspicion of Fraud Beclouds Classic Experiment." Science 194, 26 November 1976: 916-919.

Recent analyses have led to charges of scientific fraud against an eminent English psychologist, the late Cyril Burt, whose work has figured prominently in the debate about racial differences and intelligence.

Wade, Nicholas. "Recombinant DNA: New York State Ponders Action to Control Research." Science 194, 12 November 1976: 705-706.

New York is the first state to consider action to control research on recombinant DNA. This article reviews some of the highlights of recent hearings.

Wade, Nicholas. "Recombinant DNA: A Critic Questions the Right to Free Inquiry." Science 194, 15 October 1976: 303-306.

A sketch of the arguments advanced by biologist Robert Sinsheimer, an opponent of recombinant DNA research whose misgivings stem from questions other than immediate health hazards.

Walsh, John. "Congress: Election Impacts Atomic Energy, Science Committees." Science 194, 19 November 1976: 812-814.

An analysis of the implications of the November election for congressional committees dealing with science, technology, and atomic energy.

Walsh, John. "ICSU: Seeking to Separate International Science, Politics." Science 194, 5 November 1976: 587-589.

The International Council of Scientific Unions (ICSU) is an advocate and organizer of international scientific programs and a champion of freedom of scientists to participate in its activities. This article reviews some of the political issues currently facing the organization.